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II. Solution by J. SCHEFFER, A. M., Hagerstown, Md., and A. H. HOLMES, Brunswick, Me.

By clearing of fractions, adding the four resulting equations and solving for $x-a$, we have

$$x-a=b(\lambda-\mu-\nu+s)/(\lambda+\mu+\nu+s)\ldots(1).$$

Also, after the equations are cleared of fractions, by subtracting the sum of the second and third from the sum of the first and fourth, and solving for $x+a$, we have

$$x+a=b(\lambda+\mu+\nu+s)/(\lambda-\nu-\mu+s)\ldots(2).$$

Multiplying (1) by (2), we have $x^2-a^2=b^2$ or $x^2=a^2+b^2$.

Also solved by G. W. Greenwood and G. B. M. Zerr.

Professor Greenwood furnished two solutions, the first of which made use of the vanishing of the determinant of the coefficients of λ, μ, ν, s in order that the four equations be consistent. The second solution was obtained by finding the values of μ/ν, ν/λ, s/λ in any three of the four equations and substituting them in the remaining equation.

Dr. Zerr solved each of the four equations for $x\lambda$, $x\mu$, $x\nu$, and xs, respectively, and added the square of the resulting equations. By dividing this last equation by $\Sigma\lambda^2$, x^2 is immediately found.

Professors Zerr and Greenwood also sent in solutions of 271.

GEOMETRY.

300. Proposed by J. J. QUINN, Ph. D., Scottdale, Pa.

Trisect an angle by means of a tractrix.

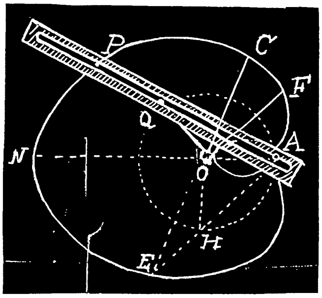
No solution has been received.

301. Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

Apply the locus of $r=a(1+2\cos\theta)$ to the trisection of an angle. Describe the curve by continuous motion.

Solution by B. F. FINKEL, Ph. D., Drury College, Springfield, Mo.

To describe the curve by continuous motion, we may construct an instrument of the following description:



Take a bar AP and cut a path, indicated in the figure by the continuous white line, equal in length to four times the radius OA of the circle. Fasten the radius OQ at the middle point, Q, of the bar AP by means of a joint. Fasten the other end, O, of the radius at O. At P, a distance from Q equal to OQ, insert a pen point. Then if the path in the bar is set over a fixed pin at A, at a distance from O equal to OQ, the point P will describe the curve as the bar is made to move so as to keep A in the path of the bar.

To trisect an angle, for example, the angle AOC, by means of this curve, produce CO to E and draw EA. Also draw OH; then FO drawn parallel to EA makes the angle $FOC=\frac{1}{3}\angle AOC$. For since $EH=HO$, by construction of the curve, $\angle OEH=\angle EOH$. But $\angle OHA,=\angle OAH,=\angle OEH+\angle EOH=2\angle OEH$. Hence, $\angle OEH+\angle OAE,=3\angle OEH,=\angle AOC$, or $\angle OEH,=\angle FOC=\frac{1}{3}\angle AOC$.

After this department, in the last issue, was in type, we received solutions of problem 299 from Professors Scheffer, Zerr, and Greenwood. Professors Scheffer and Greenwood's solutions consisted in connecting a point, G, of the ellipse with the foci F, F'. M, the middle point of FG, is taken for the center of the circle described on the focal radius, FG, as a diameter. The line AM joining M and A, the center of the ellipse, is $\frac{1}{2}F'G$, since $AF=AF'$ and M is the middle point of FG. But $\frac{1}{2}AF'=\frac{1}{2}(2a-AF)=a-\frac{1}{2}AF$, from the definition of the ellipse. Hence, MA, the distance between the centers of the auxiliary circle and the circle described on $AF=a-\frac{1}{2}AF$, the difference of their radii. Hence the circles touch.

Dr. Zerr's solution, which was analytical, made use of the same property.

CALCULUS.

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228. **Proposed by B. F. FINKEL, Ph. D., Professor of Mathematics and Physics, Drury College, Springfield, Mo.**

A sphere, radius r, is dropped into a conical vessel whose vertex angle is 60°. Find the contents of the vessel between the vertex and the sphere by means of the formula, $V=\int\int\int dx\,dy\,dz$.

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va., and the PROPOSER.

$x^2+y^2+z^2=r^2$ is the equation to the sphere, and $x^2+y^2=\frac{1}{3}(2r-z)^2$ is the equation to the cone. Eliminating z we get $y=\sqrt{(\frac{3}{4}r^2-x^2)}$.

$\therefore y=\sqrt{(\frac{3}{4}r^2-x^2)}=y'$ to $y=0$, $x=\frac{1}{2}r\sqrt{3}=x'$ to $x=0$.

$$\therefore\ v=4\int_0^{x'}\int_0^{y'}[2r-\sqrt{3}\sqrt{(x^2+y^2)}-\sqrt{(r^2-x^2-y^2)}]dxdy$$

$$=4\int_0^{x'}\Big[r\sqrt{(\tfrac{3}{4}r^2-x^2)}-\tfrac{1}{2}(r^2-x^2)\sin^{-1}\sqrt{\frac{\frac{3}{4}r^2-x^2}{r^2-x^2}}$$

$$-\tfrac{1}{2}\sqrt{3}\,x^2\log\left(\frac{\sqrt{(\frac{3}{4}r^2-x^2)}+\frac{1}{2}r\sqrt{3}}{x}\right)\Big]dx$$

$$=4(\tfrac{3}{16}\pi r^3-\tfrac{1}{64}\pi r^3+\tfrac{1}{12}\pi r^3-\tfrac{1}{6}\pi r^3-\tfrac{3}{64}\pi r^3)=\tfrac{1}{6}\pi r^3.$$

229. **Proposed by J. EDWARD SANDERS, Reinersville, Ohio.**

Solve the differential equation $d^2y/dx^2=axy$.

Solution by S. A. COREY, Hiteman, Iowa, and LEROY D. WELD, Coe College, Cedar Rapids, Iowa.

Let $y=c_0+c_1x+c_2x^2+c_3x^3+c_4x^4+c_5x^5+$ etc. ...(1).